"Heaven's striker": road of courage and self-discovery

Himmelsstürmer – Weg des Mutes und der Selbstfindung

A la conquête des nuages – la voie du courage et la quête de son essence propre

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1. Introduction

A unique construction called Skywalk which is unparalleled in Central Europe has risen at Dolní Morava under the mountain massif Kralický Sněžník an elevation of 1,116 meters. The name as such suggests that it is a construction of an observation path which rises up to 58.5 meters above the surrounding sloping terrain and clearly dominates the ridge of Slamník from the distance of several kilometers already. The architectural design comes from a creative workshop of a well-known architect Zdeněk Fránek, while the preparation of the implementing documentation, the static determination and the implementation of the construction as such were assumed by our company Taros Nova.

A distance of 750 meters and an elevation difference of 38 meters have to be overcome while ascending. The footbridge is constructed in such a way to be accessible also for prams and wheelchairs all year round.

2. Description of the construction

The entire construction is composed of several functional units. The first one is represented by the access walkway which meanders among trees at a height of less than 30 cm above ground (Fig. 1). It is formed by a floor made from spruce planks and it is 111 meters long.

Figure 1: Walkway which meanders among trees

This walkway is connected to the entrance building which is used as a ticket booth and a shop with promotion materials including a footwear rental shop in winter months. The top-view shape of the entrance building is based on ellipse; the length of the building is 18.5 meters and its width is 11.5 meters.

Figure 2: Entrance building

The entrance building is followed by the observation path as such which meanders around the three towers.

The path is ended by the so-called tree-nail which is on brackets above the valley at 11 meters approximately. Besides the view of the entire mountain massif of Kralický Sněžník including the description of individual hilltops on panorama boards, brave persons may use an adrenaline attraction, a so-called relaxing net which is stretched in the free space of the tree-nail (Fig. 3).


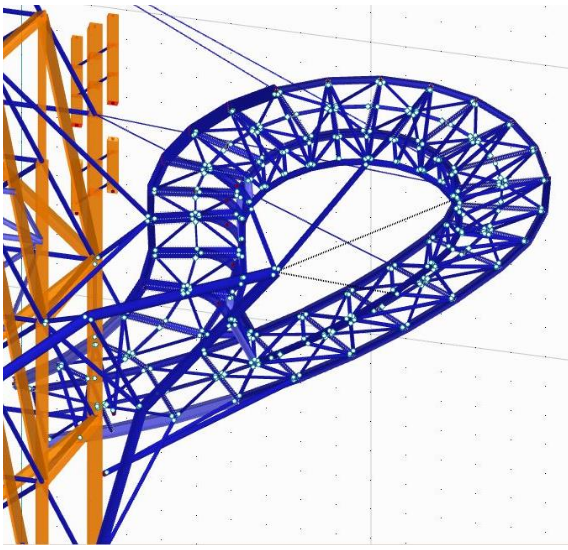

Figure 3: Viewing platform with relaxing net

Lovers of adrenaline experiences may crawl through a netted sleeve interconnecting two levels of the footbridge or they may slide down through a unique 101 meters long spiral chute made from stainless steel.

Figure 4: Adrenaline attraction – connection between two levels

3. Technical solutions

A suitable static determination was one of the tasks the resolution of which was the basis of next design work as well as the course of the implementation as such. The structure had to be designed in such a way to be assembled in the relevant terrain and to withstand extreme load which may occur in this mountain locality. Wind gusting up to 160 kilometers per hour may occur here and the structure is considerably exposed to hoar-frost too. The target was also to preserve as much as possible the architect's vision and to design the structure to be as subtle as possible. A detailed 3D design model for static and dynamic analysis and was carried out in a software which uses the finite-element method.

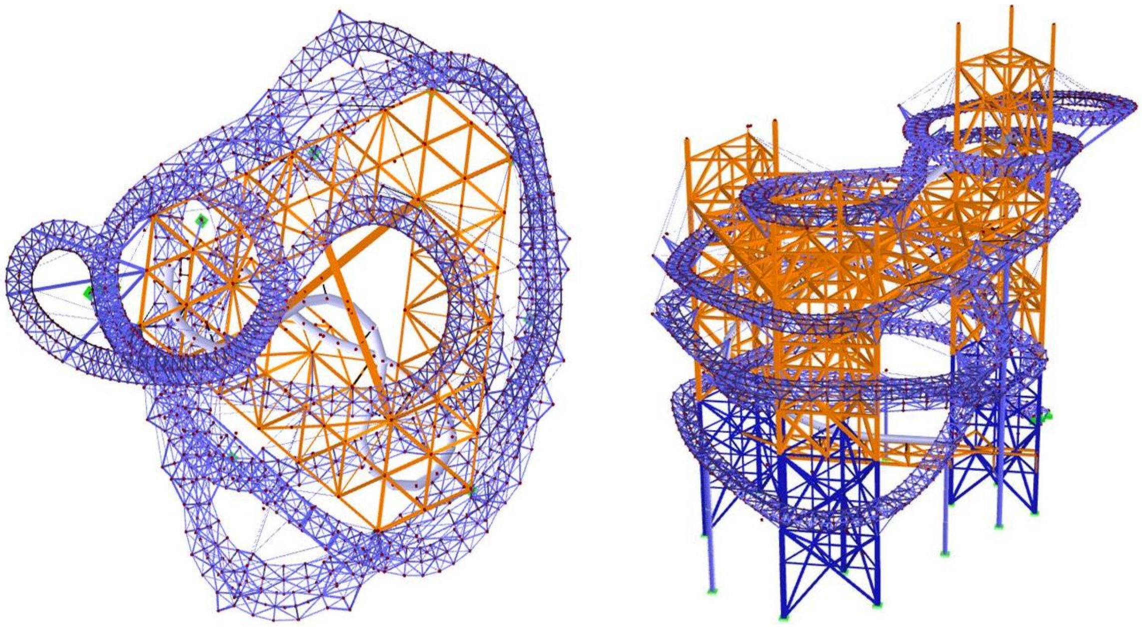

Figure 5: 3D design model for static and dynamic analysis

The crucial architectural element is represented by three towers, 58, 50 and 44 meters high, which form the main load-bearing structure of the construction (Fig.6). The top-view shape of the towers is formed by an equilateral triangle of a side length equal to 10 meters, all three towers then also form an equilateral triangle with mutual distance of 30 meters.

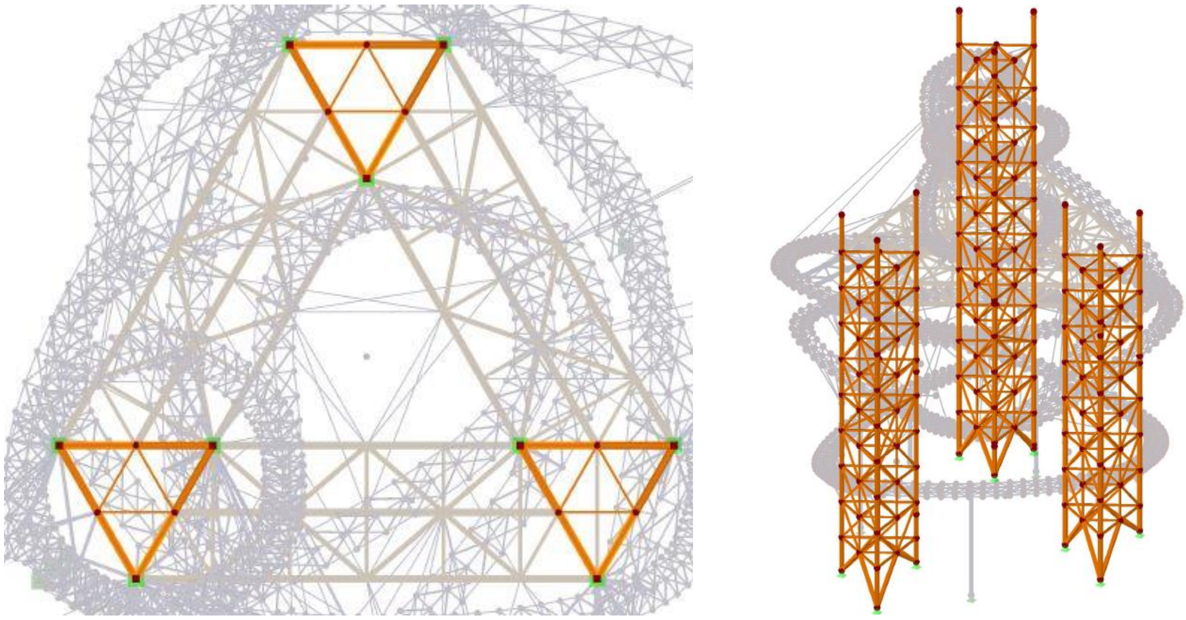

Figure 6: The main load-bearing structure of the construction

The static determination of the towers is in form of a truss structure with pin joints and this truss structure is mostly formed with glulam wooden poles and with steel diagonals.

Anchorage of the towers in the foundation footings is done by means of 24 threaded rods of diameter equal to 64 mm. The highest tower is formed by 10 modules about 5 meters high and the entrance to the spiral chute and the end of the footbridge (so-called tree-nail) are located here. All three towers are reinforced at their upper level with a so-called ring which interconnects the individual towers and forms an inclined plane respecting the heights of individual towers. The ring forms a three-dimensional truss structure, wood-steel, with a triangle-shaped cross section.

With regard to large load of the towers, the bottom part (4 modules in total) is formed by steel welded profiles 250x10 mm faced with massive larch planks of thickness equal to 60 mm. The diagonals and horizontals are made from rolled profiles of a circular cross-section of dimensions equal to 177.8/10. The entire remaining upper part of the towers is made from glued laminated timber with steel joints wherein steel struts are anchored as well as pull rods which bear the footbridge. Individual joints are resolved by means of steel blades which are embedded into the wooden glued elements of maximum dimensions equal to 600/600 mm and interconnected with steel bolts and pins. The struts and verticals are anchored in the steel joints by means of tenons, tubular horizontals and intermediate struts are anchored by means of a group of screws.

Figure 7: Anchoring of columns of main load-bearing structure

The assembly interconnection of the corner columns of individual towers between modules is done through angle plates mutually interconnected by means of high-strength screws. All steel elements are coated with refractory zinc and the wooden exposed elements are coated with an impregnated glazing paint.

The footbridge made from steel coated with refractory zinc with a spruce floor meanders around the towers. The load-bearing structure of the footbridges is mostly formed by a steel-made truss structure which is suspended or supported on the towers (Fig. 8). The footbridge is divided into 46 assembly segments which are interconnected by means of friction-type connections with screws of the strength class 10.9.

Figure 8: Assembly of main load-bearing structure of the footbridges

The footbridge is supported by 202 struts and brackets and is suspended on 43 systemic tension rods. In some cases, it was necessary to solve complex joints which have appropriate rigidity and can carry internal forces (Fig. 9)

Figure 9: Individual joints made from steel plates with thickness 25 mm

Wooden load-bearing elements are manufactured from glued laminated timber, strength class GL24h. The type connecting material and type elements are made from steel according to relevant standards, strength 8.8, 10.9. All steel elements are manufactured from steel S355. The systemic tension rods are manufactured from steel S460.

4. Conclusion

It was very difficult to imagine the complexity of the entire structure and the demanding character of the designing and implementation from a gross architectural visual representation. Whereas a common period of time to create a design of this level of demands is ten months in advance, we had only 9 months in this case to prepare the project documentation, to carry out geological survey, to arrange subcontractors, material, machines and equipment and to carry out the construction as such.


Figure 10: Adrenaline attractions – tube slide in autumn and in winter

The designing, production and construction thus took place concurrently. At the same time, the construction is so complicated that some six up to seven moves had to be thought out in advance like in a chess game. There was no room for mistakes and it was this very aspect of their corrections which caused extremely tense situations, days and months when everybody worked continuously day and night - in offices as well as on the construction site. The result of this effort is the three towers that can withstand wind speeds up to 200 km/h and can carry 4,000 people on footbridge. The highest point of the viewing platform is 55 meters above the ground. 550 m3 of glued laminated wood, 380 tons of steel and 40,000 pieces of connecting materials have been used for the entire structure.


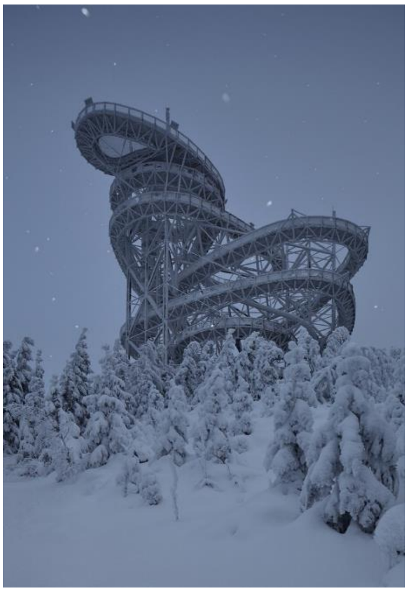

Figure 11: Overall views in autumn and in winter